ONTARIO PARKS

# Inverhuron

## Vegetation Management Plan

Ontario

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# Inverhuron

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Ontario

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## Approval Statement

I am pleased to approve the Inverhuron Vegetation Management Plan. This plan has been developed to meet the commitment of the *Inverhuron Park Management Plan* (2001) to prepare a vegetation resource stewardship strategy for the park. It has also been developed in accordance with *A Class Environmental Assessment for Provincial Parks and Conservation Reserves* (2005). This document recommends specific management techniques and provides guidelines for the vegetation issues facing park managers.

This plan will be reviewed periodically to address changing issues or conditions and advances in vegetation management practices.

I extend my sincere thanks to all those who participated in the consultation process. All comments received were carefully considered during the preparation of this document.

Yours truly,

Peter Sturdy
Zone Manager
Southwest Zone, Ontario Parks.

February 11, 2008
Date

## TABLE OF CONTENTS


1.0 INTRODUCTION ..... 1
1.1 Location and Site Description ..... 1
1.1.1 Regional Ecology ..... 1
1.1.2 Soils and Physiography ..... 1
1.1.3 Ownership and Park History ..... 1
1.1.4 Previous Vegetation Surveys ..... 2
1.1.5 Zoning ..... 3
1.2 Policy Framework ..... 3
1.3 Historic Influence on Vegetation Communities ..... 4

2.0 VEGETATION COMMUNITIES ..... 5

3.0 GOAL AND OBJECTIVES ..... 7
3.1 Goal ..... 7
3.2 Objectives ..... 7

4.0 MANAGEMENT UNITS AND PRESCRIPTIONS ..... 8
4.1 General Management Prescriptions ..... 8
4.1.1 Dead and Hazardous Trees ..... 8
4.1.2 Herbicide Use ..... 8
4.1.3 Forest Fire Management ..... 9
4.1.4 Forest Insects and Diseases ..... 10
4.1.5 Planting ..... 10
4.1.6 Grass Mowing ..... 10
4.1.7 Campgrounds / Trails ..... 10
4.1.8 Transplanting ..... 10
4.1.9 Seed Collecting ..... 10
4.1.10 Pioneer Cemetery ..... 11
4.2 Vegetation Management Units and Prescriptions ..... 11
4.2.1 Vegetation Management Unit A: Beach / Dunes ..... 11
4.2.2 Vegetation Management Unit B: Treed Sand Dunes ..... 14
4.2.3 Vegetation Management Unit C: Coniferous Forest ..... 15
4.2.4 Vegetation Management Unit D: Day Use / Campgrounds ..... 15
4.2.5 Vegetation Management Unit E: Exclusion Zone ..... 16

5.0 NON-NATIVE AND INVASIVE SPECIES MANAGEMENT ..... 17

6.0 SPECIES AT RISK ..... 18
6.1 Pitcher's Thistle (*Cirsium pitcheri*) ..... 18
6.2 Dwarf Lake Iris (*Iris lacustris*) ..... 19
6.3 Ram's Head Lady's Slipper (*Cypripedium arietinum*) ..... 19
6.4 American Beachgrass (*Ammophila breviligulata*) ..... 19
6.5 Great Lakes Wheat Grass (*Elymus lanceolatus* ssp. *psammophilus*) ..... 19
6.6 Sand Reed Grass (*Calamovilfa longifolia* var. *magna*) ..... 20
6.7 Blue-leaf Willow (*Salix myricoides* var. *myricoides*) ..... 20
6.8 Low Nutrush (*Scleria verticuillata*) ..... 20
6.9 Puccoon (*Lithospermum carolininense* var. *croceum*) ..... 20
6.10 Locally Rare Plants in Inverhuron Provincial park ..... 20
6.10 Rare Invertebrates with Dune Association ..... 21

7.0 REASEARCH AND MONITORING ..... 23
7.1 Scots Pine Plantations ..... 23
7.2 Pitcher's Thistle Monitoring ..... 23
7.3 Campground Monitoring ..... 23

8.0 IMPLEMENTATION PRIORITIES ..... 24

9.0 SUMMARY OF PUBLIC CONSULTATION AND ENVIRONMENTAL ASSESSMENT REQUIREMENTS FOR IMPLEMENTATION ..... 25

10.0 PLAN AMENDMENT AND REVIEW ..... 26

11.0 REFERENCES ..... 27

## LIST OF APPENDICIES

APPENDIX 1: Site Conditions Documentation Checklist ..... 30
APPENDIX 2: Dead and Hazardous Trees Treatments ..... 31
APPENDIX 3: NHIC Conservation Ranks ..... 32
APPENDIX 4: Use of Sand Fencing ..... 34
APPENDIX 5: American Beachgrass Planting ..... 35
APPENDIX 6: Invasive Plants at Inverhuron Provincial Park ..... 36
APPENDIX 7: Invasive Species Control Techniques ..... 37

## LIST OF FIGURES

Figure 1: Regional and Local Setting ..... 2
Figure 2: Zoning ..... 3
Figure 3: Vegetation Communities ..... 6
Figure 4: Vegetation Management Units ..... 12

## LIST OF TABLES

Table 1. Preliminary ELC Vegetation Types in Inverhuron Provincial Park ..... 5
Table 2. Locally rare or uncommon plants in Inverhuron Provincial Park ..... 20
Table 3. Rare dune associated arthropods detected in Inverhuron Provincial Park ..... 21

# 1.0 INTRODUCTION

## *1.1 Location and Site Description*

Inverhuron Provincial Park is situated on Lake Huron off Hwy. 21, 14.5 km north-east of the community of Kincardine and is a historical class park, 288 ha in size (Figure 1) (OMNR 2000). The community of Inverhuron borders the park. Inverhuron lies within the amalgamated Municipality of Kincardine, County of Bruce (OMNR 2000).

### 1.1.1 Regional Ecology

Inverhuron Provincial Park is located in Ecoregion 6E, the Lakes Simcoe-Rideau Ecoregion, which closely corresponds to the Great Lakes-St. Lawrence Forest Region, Huron Ontario Section (Hills 1959, Rowe 1972, Crins and Uhlig 2000, Crins 2002). More specifically, the park is located in Ecodistrict 6E-2 (Kincardine), which spans along the eastern shore of Lake Huron, from the south end of the Bruce Peninsula to north of Grand Bend (Hills 1959). Hills (1959) described Ecodistrict 6E-2 as "a plain of lake-laid clay and silt of moderate lime content with local areas of high lime till and low lime sand".

### 1.1.2 Soils and Physiography

Inverhuron is located on a former lake plain associated with Lake Nipissing, which was created following the last glacial period. The topography is generally flat with some rolling sections. Topographic features include the former glacial lake shoreline in the form of gravel strands and sand dunes. The park is underlain by Palaeozoic sedimentary rocks of the Middle Devonian Detroit River Group, which are approximately 370 million years old. The Little Sauble River crosses the park before emptying into Lake Huron at the park's southern boundary. (OMNR 2000, Chapman and Putnam 1984).

The soils in Ecodistrict 6E-2 are grey-brown podsolics except in areas where there is limestone till and limestone gravel near the surface. Where limestone gravel is near the surface brown forest soils are common. Hills (1959) indicates that "Bisequia profiles are common: [and] brown podsolics are usually superimposed on grey brown podsolics under hardwoods and podsols under conifer[s]". The soil development in the park is shallow, with the deepest soils being "east of the head of Inverhuron Bay continuing in a broad band to the north-eastern corner of the park", and described as being a clay loam (Fitzgerald 2000, Helling *et al.* 1970). The remainder of the park consists of sandy soils on dunes and forested dunes in the south-eastern portions of the park (Helling *et al.* 1970).

### 1.1.3 Ownership and Park History

The park itself is owned by Ontario Power Generation and is on lease to the Ontario Ministry of Natural Resources. As a condition of the operating licence for Bruce Nuclear, Ontario Power Generation has retained a 914 m radius *exclusion zone* in the northwest corner of the park restricting access and use of the area for public safety (OMNR 2000).

The former park campground was phased out in 1976 because of safety concerns related to the manufacturing of heavy water at the adjacent Bruce Nuclear Power Development (OMNR 2000). Ontario Power Generation no longer produces heavy water on site, which has allowed for the re-opening of the park campground. Prior to being phased out, the original campground had been in operation for over 25 years. Camping facilities have since been re-established following the old campground footprint closely (OMNR 2000).

*Figure 1: Regional and Local Setting*

### 1.1.4 Previous Vegetation Surveys

There have been a number of vegetation surveys conducted at Inverhuron in the past, identifying at least 586 species of vascular plants within the park (See Section 3 Vegetation Communities). Past vegetation surveys include:

- *An Annotated Checklist of the Vascular Plants of Inverhuron Provincial Park* (Johnson and Parker 1975).
- *Botanical Reconnaissance of the Gunn Point-Holmes Bay Portion of Inverhuron Provincial Park* (Johnson 1998).
- *Botanical Inventory of Inverhuron Provincial Park* (Johnson 1981).
- *Known Bruce County Populations of Pitcher's Thistle (Cirsium pitcheri)* (Johnson 2000).
- *International Biological Program, Checksheet for Region 5, Area 224: Inverhuron* (Helling *et al.* 1970).

Inverhuron
Legend
Road
Regulated Park Boundary
N
Scale : 1:20,000
This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations of features, nor as a guide to navigation
Prepared by: Ontario Parks, Southwest Zone, June, 2007
Regional Map
Provincial Park
Bruce Nuclear Plant
Richards Dr
Whispering
Ontario

*Figure 1: Regional and Local Setting*

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### 1.1.5 Zoning

The park management plan (OMNR 2000) identifies four zones within the park: Historical Zone (122 ha), Nature Reserve Zone (28 ha), Development Zone (67 ha), and Natural Environment Zone (71 ha) (Figure 2).

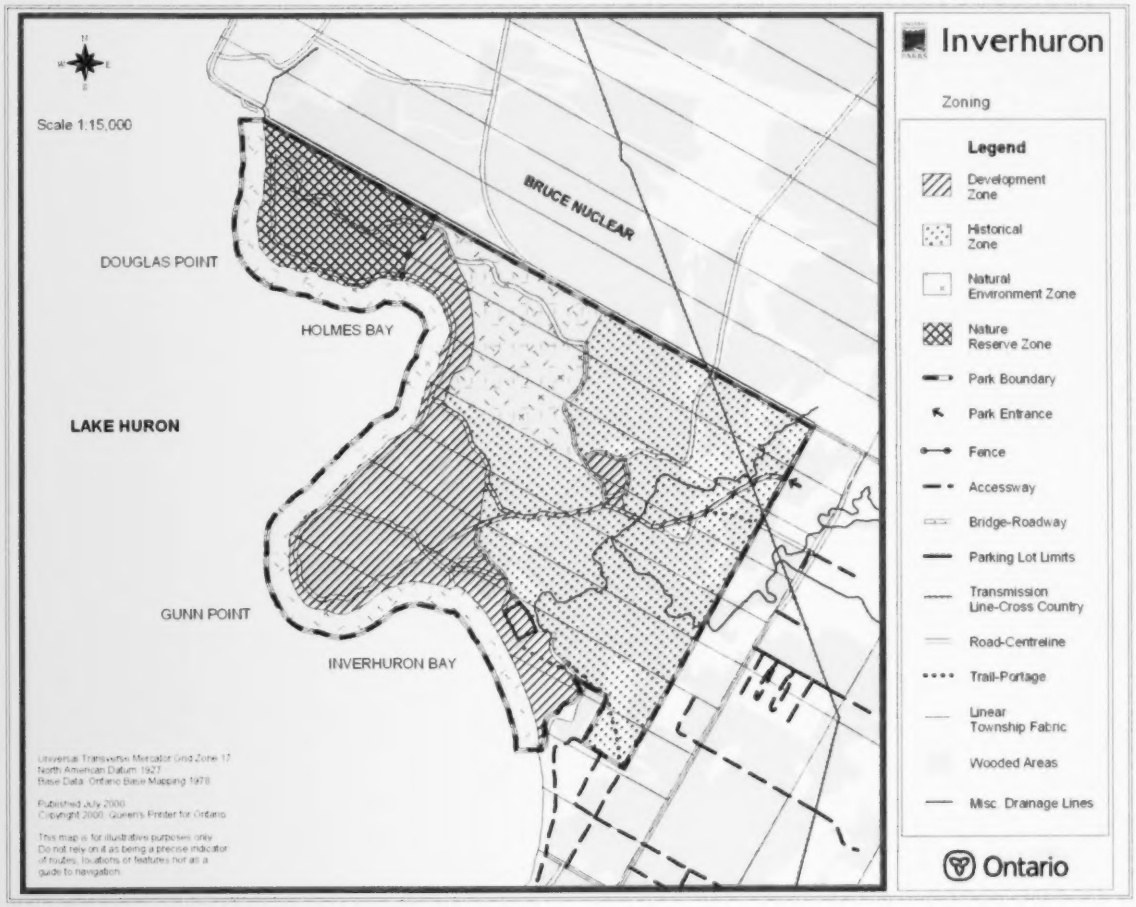


*Figure 2: Zoning*

## *1.2 Policy Framework*

This plan has been developed to guide vegetation management in the park by providing more detailed direction based on the vegetation stewardship policies listed in Section 7.2 of the *Inverhuron Provincial Park Management Plan* (OMNR 2000) and recommendations in the *Inverhuron Provincial Park Environmental Study Report* (TSH 2003). These policies are:

- Non-native plant species will not be deliberately introduced;
- Where non-native species threaten values, an eradication program may be developed;
- Missing native species may be re-established if biologically feasible and acceptable, and compatible with the historical values for which the park was established;
- Stabilization of shoreline and backshore sand dunes will be a priority;
- Agricultural practices and commercial forest operations will not be permitted;
- Maintain a natural 35 m buffer between campsites (TSH 2003);
- Protect provincially significant biological resources (TSH 2003).

### *1.3 Historic Influence on Vegetation Communities*

Most of the vegetation in the park is second-growth forest and in the early stages of succession because of logging and land clearing prior to park establishment (OMNR 2000). The bulk of the park is coniferous forest of which Eastern White Cedar (*Thuja occidentalis*) is the dominant species (TSH 2003). More mature forests are present along the banks of the Little Sauble River, which are the result of being protected as a timber preserve from a sawmill that historically operated near the mouth of the river (TSH 2003). Agricultural activities in the 1800s have left remnants of settlers' attempts to cultivate the land, such as overgrown fields near the park entrance (NHIC 2005). Other examples include remnants of garden escapees such as Lilacs (*Syringa vulgaris*) and irises (*Iris* sp.) brought by settlers, homesteaders and cottagers (Helling *et al.* 1970, Fitzgerald 2000, 2001). From the 1950s to the 1970s some park staff lived in the park and planted non-native garden species in the areas around their residence and park buildings, as well as trees to stabilize the dunes (N. Toth, Personal Communication 2006). There were also major fires in the 1880s within the park boundaries, which caused damage to vegetation and altered the landscape (Fitzgerald 2001). A fire in 1887 is cited as having destroyed most of the former town of Inverhuron's buildings and vegetation, resulting in the mobilization of exposed sand (Fitzgerald 2001).

In an effort to stabilize sand dunes, large portions of the dunes have been planted with non-native species such as Scots Pine (*Pinus sylvestris*) and Austrian Pine (*Pinus nigra*) (TSH 2003).

In the vicinity of the new campground development, remnants of the old campground facilities can still be detected in the form of transitional vegetation (young cedars and Balsam Fir *(Abies balsamea)*) growing along old roads and trails (TSH 2003).

## 2.0 VEGETATION COMMUNITIES

To assist with the vegetation management planning process, a preliminary *Ecological Land Classification* (ELC) for the park has been prepared (Biscaia and Gurr 2006). The classification was developed using a combination of past botanical inventories conducted by Helling *et al.* (1970), Johnson and Parker (1975), Johnson (1981), Johnson (2000); ortho photo interpretation and a site visit conducted in the fall of 2005. It is recommended that a full and complete ELC be completed at a later date to assist with vegetation management in the park.

The ELC classifications used are consistent with Lee *et al.* (1998) and its updates (Lee 2005). A summary of the ELC communities and descriptions in Inverhuron Provincial Park is provided in Table 1 and Figure 3.

Inverhuron Provincial Park is primarily made up of 10 distinct ELC vegetation community types (Table 1). The checklist of the vascular plants of Inverhuron Provincial Park by Johnson and Parker (1975), along with updates by Johnson (1981) and Johnson (unpublished data) identifies at least 586 species of vascular plants including a number of provincially significant species. The park is home to the provincially and federally endangered Pitcher's Thistle (*Cirsium pitcheri*) (Johnson 2000), Great Lakes Wheat Grass *(Elymus lanceolatus* ssp. *psammophilus*) (G5, S3) (TSH 2003), American Beachgrass (*Ammophila breviligulata*) (G5, S3), and Sand Reed Grass (*Calamovilfa longifolia* var. *magna*) (G5, S3).There are also reports of the provincially and nationally threatened Dwarf Lake Iris (*Iris lacustris*) (G3, S3) and the provincially and nationally threatened Ram's Head Lady's Slipper (*Cypripedium arietinum*) (G3,S3) that require further verification (TSH 2003).

*Table 1. Preliminary ELC Vegetation Types in Inverhuron Provincial Park*

| ELC Code | ELC Community | Dominant Vegetation |
|---|---|---|
| FOCS3-1 | Dry White Cedar Calcareous Bedrock Coniferous Forest Type | Eastern White Cedar, Balsam Fir |
| SWMM1-1 | White Cedar-Hardwood Mineral Mixed Swamp Type | Eastern White Cedar, Red Ash (*Fraxinus pennsylvanica)* and Red Osier Dogwood (*Cornus stolonifera*) |
| FOCM4-3 | Fresh-Moist White Cedar-Balsam Fir Coniferous Forest Type | Eastern White Cedar, Balsam Fir, Willow (*Salix*) and dogwoods |
| CUM1-1 | Dry-Moist Old Field Meadow Type | White Ash (*Fraxinus americana*), Eastern White Cedar, Staghorn Sumac (*Rhus typhina*), |
| SHOR1-1 | Shrubby Cinquefoil Calcareous Open Bedrock Shoreline Type | Cinquefoils (*Potentilla*), Willow, Grasses (*Gramineae*), Asters (*Asteraea)* and Goldenrods (*Solidago)* |
| SHOM1-2 | Sea Rocket Sand Open Shoreline Type | Devoid of vegetation |
| SBOD1-1 | Little Bluestem-Switchgrass-Beachgrass Open Graminoid Sand Dune Type | American Beachgrass, Tall Wormwood (*Artemisia caudata*), Sand Reed Grass, Beach Pea (*Lathyrus japonicus*) and Pitcher's Thistle |
| SBTD1-2 | Balsam Poplar Treed Sand Dune Type | Balsam Poplar (*Populus balsamifera*) and Willow |
| SBTD1-20 | White Cedar-Balsam Fir Treed Sand Dune Type | Eastern White Cedar, Balsam Fir, Scots, Austrian Pine, and Trembling Aspen (*Populus tremuloides*) |
| SBOB1-3 | Dry Bracken Fern Open Forb Sand Barren Type | Eastern White Cedar, Scots Pine, Balsam Fir, Canada Blue Grass (*Poa compressa*), Great Lakes Wheat Grass |

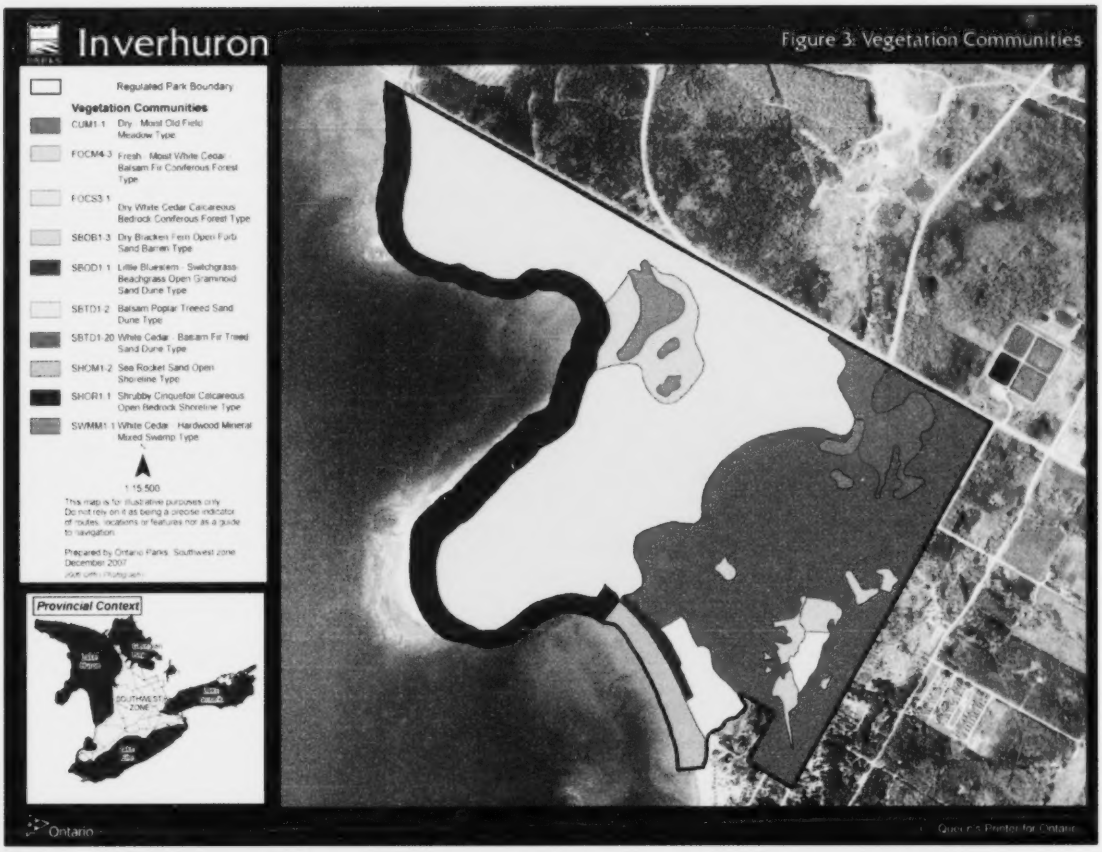
Inverhuron
Figure 3: Vegetation Communities
Regulated Park Boundary
Vegetation Communities
CUM1.1 Dry - Moist Old Field Meadow Type
FOCM4-3 Fresh - Moist White Cedar - Balsam Fir Coniferous Forest Type
FOCS3.1 Dry White Cedar Calcareous Bedrock Coniferous Forest Type
SBOB1-3 Dry Bracken Fern Open Forb Sand Barren Type
SBOD1.1 Little Bluestem - Switchgrass Beachgrass Open Graminoid Sand Dune Type
SBTD1-2 Balsam Poplar Treeed Sand Dune Type
SBTD1-20 White Cedar - Balsam Fir Treed Sand Dune Type
SHOM1-2 Sea Rocket Sand Open Shoreline Type
SHOR1.1 Shrubby Cinquefoil Calcareous Open Bedrock Shoreline Type
SWMM1-1 White Cedar - Hardwood Mineral Mixed Swamp Type
1:15,500
This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations or features nor as a guide to navigation.
Prepared by Ontario Parks, Southwest zone December 2007
Provincial Context
Ontario
Queen's Printer for Ontario

*Figure 3: Vegetation Communities*

## 3.0 GOAL AND OBJECTIVES

### *3.1 Goal*

The goal of the Inverhuron Provincial Park Vegetation Management Plan is to:

Provide direction on vegetation management issues within Inverhuron Provincial Park to ensure the persistence of naturally occurring species and vegetation communities within the park and the natural processes that occur within them, while protecting significant cultural resources and providing for compatible recreational activities including camping, day use and heritage appreciation consistent with the park management plan.

### *3.2 Objectives*

The objectives of the Inverhuron Provincial Park Vegetation Management Plan are to:

- Conserve and, where necessary, restore viable populations of indigenous floral species, with an emphasis on protecting species at risk and their respective habitats within the park;
- Eliminate or reduce the threat of invasive exotic species where possible, with a particular emphasis on Scots Pine, while ensuring the protection of significant Aboriginal archaeological features;
- Restore or enhance natural vegetation features where possible, and processes that have been, or are in danger of being, lost or degraded;
- Provide opportunities for park visitors to appreciate and learn from the diverse floral communities of the park, in ways that do not threaten existing natural values;
- Reduce park visitor safety hazards associated with vegetation.

## 4.0 MANAGEMENT UNITS AND PRESCRIPTIONS

The *Inverhuron Park Management Plan* outlines general vegetation management policies (See Section 1.2), which have provided the basis for the more detailed prescriptions outlined here, based on vegetation management issues and vegetation communities found throughout the park. Section 4.1 outlines general management prescriptions that may be implemented throughout the entire park, whereas section 4.2 outlines management prescriptions for specific vegetation management units within the park.

Site conditions prior to the implementation of species and habitat specific management prescriptions should be well documented (i.e., presence of invasive species or species at risk) (Appendix 1). General management prescriptions carried out as part of regular park maintenance such as lawn mowing and dead and hazardous tree removal do not require the same documentation. An adaptive management approach will be taken when implementing vegetation management prescriptions to allow for modifications as necessary to ensure success.

### *4.1 General Management Prescriptions*

#### 4.1.1 Dead and Hazardous Trees

Safety will be the major deciding factor for when a tree needs to be removed, however, consideration must also be given to the importance of dead tree material and downed woody debris. Dead trees will be left standing as wildlife habitat for cavity-nesting birds and mammals in all zones at the superintendent's discretion except in instances where they pose a direct threat to public safety (OMNR 2003) and with the exception of situations where their presence:

- Obstructs efforts to maintain recreational facilities, roads, campsites, trails, day use areas, manicured lawns and the pioneer cemetery;
- Results in park visitors scavenging wood for camp fires;
- Encourages insect infestations that may be detrimental to the health of the forests.

Material that has been removed from a site can be used as firewood or could be chipped and used to help reduce erosion, or to build up an organic layer in newly developed areas.

Further guidance on the treatment of dead and hazardous trees is found in Appendix 2.

#### 4.1.2 Herbicide Use

The *Inverhuron Park Management Plan* does not address herbicide use. Herbicides that biodegrade quickly, have low soil activity and have been tested and shown to have minimal environmental impacts (e.g., glyphosate and triclopyr) (OMNR 2001) can be used for restoration activities and controlling invasive species. Use of biological control agents (if available) will be used when feasible. Use of herbicides for restoration activities and controlling invasive species will be done in consultation with the zone ecologist to determine their appropriateness. Any person working with herbicides in the park must do so under the requirements of the *Pesticides Act* and PM 2.16, *Use of Pesticides and Herbicides in Provincial Parks*.

Species such as Poison Ivy (*Rhus radicans*) may be controlled in the development zone and in other zones where park visitors may come into contact with the plant (i.e., trails) as deemed necessary. Glyphosate is currently the best control for Poison Ivy (OMNR 2001).

### 4.1.3 Forest Fire Management

Studies of the historical role of fire in this region are limited. Though fire did occur occasionally, it was much less common than in other forest regions (Van Sleeuwen 2006). Fires also help to reduce fuel loads, decreasing the likelihood of large intense fires that are difficult to control (OMNR 2005[b]).

Forest fire management involves the protection of values and the attainment of resource stewardship objectives through two main approaches:

- Fire response: The protection of people, property, and natural areas from wildfire; and,
- Fire use: The strategy of maintaining fire as an ecological process or meeting resource management objectives through the application or management of fire.

The Forest Fire Management Strategy for Ontario (OMNR 2004) provides strategic direction for the management of wildfire across Ontario. Inverhuron Provincial Park is located in the Southern Ontario Zone according to this provincial strategy. Within this zone, municipalities are responsible for providing fire response for all forest fires to protect life, property and infrastructure in accordance with the *Fire Protection and Prevention Act* (FPPA).

Fire management objectives within Inverhuron Provincial Park will focus on the prevention of personal injury, value loss, and social disruption; but will allow for the use of fire to help restore and maintain ecological integrity if deemed appropriate.

To provide detailed direction on achieving these fire management objectives, the Park will commit to writing a Statement of Fire Intent as directed by *Fire management policy for Provincial Parks and Conservation Reserves.* This statement will consider and document the role of fire in Inverhuron Provincial Park, scoping fire management objectives and opportunities. This statement will be developed in consultation between the Park Superintendent and MNR fire management personnel.

#### *Fire Response*

Given the size of the park and adjacent developed areas, unplanned fires could pose a threat to public health and safety, property and infrastructure. Therefore all forest fires will receive a full response and sustained action. Inverhuron Provincial Park is within the municipality of Kincardine and fire protection services are provided to the park by the municipality.

"Light on the land" fire suppression techniques will be used whenever feasible. These minimal impact suppression techniques do not unduly disturb natural or cultural values. Examples may include limiting the use of heavy equipment or the felling of trees during fire response.

Fire evacuation procedures will be as outlined in the Emergency and Evacuation Plans for Inverhuron Provincial Park.

#### *Fire Use*

MNR recognizes fire as an essential ecosystem process, fundamental to restoring and maintaining the ecological integrity of certain ecosystems. Fire use for ecological and vegetation management objectives in the park will be achieved by exploring opportunities for prescribed burning. Prescribed burning refers to the deliberate, planned and knowledgeable application of fire by authorized personnel to a specific land area to accomplish pre-determined objectives.

- Prescribed burning to achieve ecological or hazard reduction objectives may be considered if deemed appropriate;
- Plans for any prescribed burning will be developed in accordance with the MNR Prescribed Burn Policy, its associated planning manual, and the Class Environmental Assessment for Provincial Parks and Conservation Reserves, in cooperation with Aviation and Forest Fire Management.

### 4.1.4 Forest Insects and Diseases

Forests will be examined periodically for outbreaks of non-native forest insects and disease that may pose a threat to forest health or other park values. Control of non-native forest insects and disease will be examined on a case-by-case basis and will be carried out in consultation with the zone ecologist and OMNR forestry and entomology staff. Biological controls, such as *Bacillus thuringiensis* (Bt) will be used whenever feasible to control insect outbreaks.

### 4.1.5 Planting

Species native to the park should be used for restoration or landscape planting (See Johnson and Parker 1975). If commercial seed mixes are used to re-vegetate disturbed areas (i.e., roadsides, campgrounds, day use areas and pioneer cemetery), seed mix should be used which contains as many species native to the park as possible.

Where possible plant stock obtained from outside the park for landscape planting and restoration should be from a local seed source to ensure that they are of a similar genotype and adapted to local growing conditions. Plant stock derived from park seed may be the preferred option in many cases (see section 4.1.9).

### 4.1.6 Grass Mowing

Lawns will be mown in the development and historical zones where appropriate to maintain park buildings, recreational areas, roadways and the pioneer cemetery. In the event that the amount of area to be mowed is reduced, then careful monitoring should be done to ensure that areas left to natural regeneration are not colonized by invasive species. Consideration should be given to restoration of these areas using a herbicide to kill the non-native grasses and then planting with native forest or grassland species (depending on specific circumstances).

### 4.1.7 Campgrounds / Trails

The park campgrounds and trails will require general upkeep, including the removal of dead and hazardous trees and control of Poison Ivy and invasive species, which is permitted under sections 4.1.1, 4.1.2 and 5.0.

### 4.1.8 Transplanting

Where existing vegetation may be lost due to development, plants may be salvaged and transplanted for naturalization and restoration purposes within the park. Transplanting vegetation outside the park will be examined on a case-by-case basis and only be appropriate once park needs have been met. Preference would be given to local naturalization and restoration projects near the park.

### 4.1.9 Seed Collecting

***Seed Collecting for Use Within the Park***

Seed may be collected for use in propagation and planting within the park for restoration and naturalization purposes. Harvesting effort will be rotated and spread throughout the park. The amount of seed collected will be limited based on the species and determined in consultation with the zone ecologist (OMNR 2001). Records will be kept regarding:

- The species and amount of seed harvested;
- The location and date of harvesting;
- Where in the park the seed was used.

***Seed collecting for Use Outside the Park***

Seed collection for use outside the park will be based on the following guidelines until such time that Ontario Parks develops and approves a seed collection policy. Seed collection for use outside the park will be examined on a case-by-case basis in consultation with the zone ecologist and under the authority of the Park Superintendent. Seed collection should be for local conservation purposes only, and not for private use (i.e., private gardens) or commercial purposes (i.e., nursery stock) unless done under a partnership agreement with the park whereby the grower is propagating plant species for the park and selling a negotiated proportion of the grown stock to recover costs. Agreements for seed collecting for use outside of the park will be authorized through a memorandum of understanding or a completed *Application to Conduct Research in Provincial Parks* until such time as a specific seed collection policy is implemented. The superintendent will have final discretion on such authorizations. Approval will be based on the following considerations, guidelines and conditions:

- Where the seed will be used;
- The amount of seed required;
- Availability of seed sources outside the park;
- The harvesting method used;

The location and amount of seed harvested will be determined by park staff and the zone ecologist. The park reserves the right to request a portion of the seed for park use and the park superintendent reserves the right to cancel harvesting agreements at any time.

### 4.1.10 Pioneer Cemetery

The pioneer cemetery will continue to be maintained, including landscape planting and grass mowing as required (See Sections 4.1.5 – 4.1.6).

## *4.2 Vegetation Management Units and Prescriptions*

To facilitate the application of specific vegetation management prescriptions within the different park management zones, Inverhuron Provincial Park has been divided into vegetation management units (Figure 4). Vegetation management units are defined by vegetation communities (ELC descriptions), property boundaries, roads, existing trail systems and park zoning. The vegetation communities defined in Section 2 provide descriptions of the values for which the vegetation management units have been developed, to be consistent with the park management plan.

### 4.2.1 Vegetation Management Unit A: Beach / Dunes

Vegetation management unit A includes vegetation communities SHOR1-1 (shale beach), SHOM1-2 (wet beach), and SBOD1-1 (beach dunes). This area extends from the northern park boundary, to the southern park boundary of Inverhuron Bay along the shoreline of Lake Huron from the foredune to the water's edge, and is included within the natural environment zone (Figure 4).

Lake Huron Dune Grasslands are considered provincially very rare (S1S2) (Appendix 3: Conservation Ranks) (Jalava 2004). The dunes at Inverhuron provide significant habitat[1] for the endangered Pitcher's Thistle, which has been identified as a candidate for regulation under the provincial *Endangered Species Act* (ESA).

---

[1] **SAR *Significant Habitat*:** "Significant" is defined in the Provincial Policy Statement as follows:
"In regard to the habitat of endangered species and threatened species, [significant] means the habitat, as approved by the OMNR, that is necessary for the maintenance, survival, and/or the recovery of naturally occurring or reintroduced populations of endangered species or threatened species and where those areas of occurrence are occupied or habitually occupied by the species during all or any part(s) of its life cycle" (OMNR, 2006).

Inverhuron
Figure 4: Vegetation Management Units
Legend
Vegetation Management Units
A Beach/Dunes and Shoreline
B Treed Sand Dune
C Coniferous Forest
D Development Zone
E Exclusion Zone
1:15,500
This map is for illustrative purposes only. Do not rely on it as being a precise indicator of routes, locations or features nor as a guide to navigation
Prepared by Ontario Parks, Southwest zone December 2007
Provincial Context
Ontario

*Figure 4: Vegetation Management Units*

Provincially rare to uncommon (S3) species, including American Beachgrass, Great Lakes Wheat Grass and Sand Reed Grass, are also present in the dunes (See SAR Section 6.0).

Dune vegetation plays an important role in the dune-building process by reducing wind velocity and capturing sand (Peach 2005), and is adapted to living in a harsh environment by being tolerant of low moisture levels, temperature extremes, burial and erosion (Albert 2000).

The coastal dune environment is dynamic in nature and subject to environmental influences such as wind, wave action and water levels. As such, it is best to take an adaptive approach to managing these systems. Dunes and dune vegetation can play an important role in protecting the shoreline from erosion and preventing sand from encroaching on existing structures and facilities. The development of new facilities in the vicinity of dune environments should be well thought out. Improper planning can result in increased maintenance costs due to sand encroachment and burial and can have negative impacts on these fragile ecosystems. It is also important to consider that "beaches are inextricably linked to dunes and so management of dunes must include the proper management of beaches" (Peach 2005).

The sand dunes at Inverhuron Provincial Park present a unique challenge for park staff due to the presence of Pitcher's Thistle (See SAR Section 6.0). Pitcher's Thistle requires a certain amount of disturbance to survive and management prescriptions in this vegetation management unit may have adverse effects on the plant. Any prescription that is applied in this unit should be monitored and evaluated to determine if it is having detrimental impacts on populations of this species. (See Research and Monitoring Section 7.0) It is essential that park staff understand the balance between disturbance and stabilization for its survival.

The objectives of the management prescriptions in vegetation management unit A are to conserve and protect the shoreline and dune ecosystem and continue to support low-intensity recreational activity in the natural environment zone of the park (OMNR 2000) by pursuing the following targets:

- Conserve and protect the potentially nationally significant dune grasslands;
- Ensure that management prescriptions are consistent or not in conflict with recovery objectives in the *Pitcher's Thistle – Lake Huron Dune Grasslands Recovery Strategy* (Jalava 2004) and other recovery strategies as they are developed;
- Allow natural dune-building processes to continue by protecting habitat from development, vehicle, pedestrian and other human impacts (Jalava 2004);
- Ensure populations of critically imperilled dune species are re-established through species-specific habitat restoration and reintroduction programs (Jalava 2004).

Active management of the vegetation on the shale beach is not anticipated at this time; however, management prescriptions will be developed, implemented and evaluated on a case-by-case basis as required in consultation with the zone ecologist.

To the greatest extent possible, it is desirable to allow for natural dune processes to take their course in this vegetation management unit. Prescriptions for this vegetation management unit include:

### *Education*

Low water levels in recent years have resulted in the establishment of dune vegetation such as American Beachgrass further out on the mid-beach and in a higher density than in previous years. Dune vegetation can sometimes be aesthetically unpleasing to those who do not understand its role in dune systems. There is also a lack of understanding of the sensitivity of these features to human disturbances (Peach 2005).

Education is an essential management tool in raising awareness of the importance of protecting these sensitive features. Education can take the form of signage, literature and interpretive and outreach programs.

### *Access*

Dune and beach vegetation is sensitive to trampling from pedestrian traffic. It is important to have designated access for recreational users of the beach in the form of established trails and boardwalks. Access should be signed and well marked so as to influence human traffic patterns (Bowles and Maun 1982 as cited by Peach 2005).

Boardwalks and pathways should be angled through the foredune to prevent erosion or blowouts in the dune (Peach 2005). Boardwalks should be constructed in a manner that allows them to be elevated, allowing wind to blow under them and prevent them from accumulating sand and deal with rising dunes to minimize maintenance issues.

### *Recreational Use*

Recreational use from beach goers (swimmers, sunbathers etc.) should be promoted in the low/wet beach area that is devoid of vegetation. Recreational activity in this area reduces disturbance to sensitive dune vegetation and is less prone to erosion as the moist sand is more adhesive. Recreational users should also be encouraged to use designated access points to cross the dunes and get to the beach.

<u>Beach clean-ups</u> to maintain portions of the beach for recreational use should be conducted in the wet/low beach area only, and not encroach on dune vegetation. Cleaning of debris that impedes recreational use should be limited to hand tools, wheel barrows and small machinery to cart debris away if needed. The use of machinery on the beach is not an ideal management practice. If machinery is used to cart debris away (i.e., small ATV, tractor or gator), it should be operated on the wet beach area only. Designated entry and exit points should be established to limit the amount of disturbance to the beach and dunes. Consideration should also be given to the type and amount of debris removed from the beach such as litter vs. natural material. Some natural material including large woody debris may enhance the appearance of the beach aesthetically and organic matter washed up on beach provides some of the nutrients for the dune community.

### *Beach and Foredune Management / Maintenance Techniques*

Brush, sand fencing and American Beachgrass planting can be used on the beach and foredune to mitigate the effects of sand migration on facilities where deemed necessary. These management techniques should be kept to a minimum and caution should be exercised when using these management prescriptions in Pitcher's Thistle habitat as there is potential for adverse effects on the species (see Appendix 4: Use of Sand Fencing and Appendix 5: American Beachgrass Planting). The advice of the *Pitcher's Thistle – Lake Huron Dune Grassland Recovery Team* will be sought prior to management actions that may impact Pitchers Thistle. Management prescriptions that may adversely affect Pitcher's Thistle resulting in dune stabilization or burial will also be monitored accordingly (See Section 7.0). Sand fencing is the least permanent of the management prescriptions, allowing for modifications to be made as necessary (Peach 2005).

## 4.2.2 Vegetation Management Unit B: Treed Sand Dunes

Vegetation management unit B includes all areas within vegetation communities SBTD1-2 (Balsam Poplar Treed Sand Dune), SBTD1-20 (White Cedar-Balsam Fire Treed Sand Dune), SBOB1-3 (sand barrens) and CUM1-1 (cultural meadows) plus the southern two polygons defined as SWMM1-1 (cedar swamps). This area takes in the north-east corner of the park, extending south past the main interior park access road to the eastern park border. It encompasses portions of the parks historical and development zones (Figure 4).

The objectives of management prescriptions in vegetation management unit B are to preserve the forested dunes in a manner that protects significant archaeological and historical features, allow for the continued persistence of Pitcher's Thistle and promote the re-establishment of native species in conifer plantations by pursuing the following targets:

- Protect cultural and historical values by stabilizing shoreline and backshore sand dunes where necessary (OMNR 2000);
- Protect SAR values by allowing open areas to maintain themselves;
- Naturalize the area by removing Scots Pine and planting native species;
- Map Scots Pine plantations within the park.

### *Scots Pine Plantations*

Over time non-native conifers such as Scots Pine and Austrian Pine in this vegetation management unit should be removed. The park management plan states that stabilization of shoreline and backshore dunes is a priority (OMNR 2001). As such, the removal of large areas of Scots Pine should be carefully considered and a precautionary approach taken to reduce concerns with erosion and mobilization of sand.

Scots Pine seed can remain viable in the sand for many years (OMNR 2005[a]) and seedlings have aggressive root systems that can compete with native vegetation (Burns and Honkala 1990). Because of the seed source established in the sand at Inverhuron and in-seeding of Scots Pine from outside the park boundary, there will likely be a need for long-term management of regeneration. The Scots Pine plantations should be managed by:

- Controlling seedling regeneration by clipping seedlings off at ground level (OMNR 2005[a]);
- Under-planting with native species (Eastern White Cedar);
- Gradually thinning Scots Pine (cutting and chemical girdling) allowing native species in the understory, such as Eastern White Cedar, Balsam Poplar and Balsam Fir, to become established (OMNR 2005[a]).

Small openings in the canopy can aid in speeding up the process of natural succession and allow for native species to become established (OMNR 2005[a]). Thinning of Scots Pine should be considered only in large well treed stands with good ground cover. Areas that are determined appropriate for thinning should be assessed for:

- The size of the area to be thinned and threat of erosion and blowouts;
- Composition and density of native understory growth (OMNR 2005[a]).

Treatments that open too large an area may favour Scots Pine and non-native species regeneration (Burns and Honkala 1990). General guidelines for thinning are:

- Create canopy gaps of 3-4 trees 6-10 m in height to encourage the growth of shade-tolerant species such as Eastern White Cedar (OMNR 1996, Burns and Honkala 1990);
- Assess the response of native vegetation to release and under-plant with Eastern White Cedar where appropriate;
- Leave felled trees on site and do not operate machinery on forested dunes;
- No cutting or thinning in suitable migratory or breeding bird habitat during May 15 – July 23 (TSH 2003);
- Ideally conduct thinning in the winter months when the ground is frozen to reduce the amount of site damage.

The above management prescription should be carried out with caution in areas where cultural remains have been repatriated to ensure activities do not disturb Aboriginal burial sites. Less intrusive methods of controlling Scots Pine in these areas include chemical girdling and under-planting to ensure that sites remain stabilized.

***Cultural Values***

"In recognition of the significant Aboriginal archaeological features located within Inverhuron Provincial Park [in relation to the removal of Scots Pine and dune stabilization], Ontario Parks will have special regard for local First Nations particular interests. Respect and protection of archaeological and cultural features are a key component of this park [vegetation management plan]. The Chippewas of Saugeen and Nawash First Nations will be consulted on related issues of concern during the implementation of this plan" (OMNR 2000).

*Motorized Vehicle Use*

The *Provincial Parks and Conservation Reserves Act* prohibits the public from using All Terrain Vehicles (ATV) in provincial parks. Since ATV use is evident in portions of the forested dunes, fencing, signage and enforcement should be used to mitigate the impacts of these activities.

### 4.2.3 Vegetation Management Unit C: Coniferous Forest

Vegetation management unit C includes those portions of the FOCS3-1 (coniferous forest) vegetation community located outside of the campground, the FOCM4-3 (moist cedar forests) community and the northern three polygons defined as SWMM1-1 (cedar swamps) adjacent to Holmes Bay. These areas extend south of the northern park border, taking in the parks natural environment zone and part of the historical zone north of the interior park access road (Figure 4).

The objective of management prescriptions in vegetation management unit C is to allow for natural processes in the surrounding coniferous forests to continue. Active management of the coniferous forests is not anticipated at this time; however management prescriptions will be implemented and evaluated on a case-by-case basis as required in consultation with the zone ecologist. The targets for this vegetation management unit are to:

- Maintain the area in a forested state;
- Allow for natural processes of the ecosystem to continue.

### 4.2.4 Vegetation Management Unit D: Day Use / Campgrounds

Vegetation management unit D includes those portions of vegetation communities SBTD1-2 (Mineral Shoreline), SBTD1-20 (White Cedar-Balsam Fir Treed Sand Dune), FOCS3-1 (Dry White Cedar Calcareous Bedrock Coniferous Forest), FOCM4-3 (Fresh-Moist White Cedar-Balsam Fir Coniferous Forest) and SBOD1-1 (Graminoid Sand Dune) within the campground and day use areas in the parks development zone (Figure 4).

The objective of management prescriptions in vegetation management unit D is to promote the continued use of campgrounds and day use facilities for park users, while at the same time minimizing the impacts on the surrounding communities. The targets of this vegetation management unit are to:

- Maintain campground and day use facilities and implement vegetation management prescriptions on a case-by-case basis as required;
- Restore natural areas between campsites using native plants derived from park or local seed sources;
- Allow for the expansion of campground facilities (i.e., group camping) (OMNR 2000).

Vegetation management prescriptions within this unit are generally covered by the General Management Prescriptions outlined in section 4.1.

### 4.2.5 Vegetation Management Unit E: Exclusion Zone

Vegetation management unit E is represented by the Ontario Power Generation's exclusion zone in the north-west corner of the park (Figure 4). It includes the entire Nature Reserve Zone and the portion of the Natural Environment Zone between the Nature Reserve Zone and the shoreline.

This vegetation management unit is maintained by Ontario Power Generation (OPG), and no use of the area will be made without written permission of the Atomic Energy Control Board (OMNR 2000). If access or management of this area is required, it will be done in full consultation with and with permission of, the above agencies.

## 5.0 NON-NATIVE AND INVASIVE SPECIES MANAGEMENT

The *Inverhuron Park Management Plan* states that non-native plants will not be deliberately introduced and allows for an eradication plan to be developed when they threaten a particular park value (OMNR 2000). Where uncertainties exist as to the threat of non-native species to the park ecosystem, monitoring and research to investigate the issue should be pursued in all park zones (OMNR 2001).

Non-native garden escapees associated with historic settlements within the park that do not exhibit invasive tendencies, may be left in place as they are historical resources in an historic class park.

Approximately 27% of the plant species listed as occurring in the park by Johnson and Parker (1975) and Johnson (1981) are not native to the park. Species such as Scots Pine and Austrian Pine have been deliberately introduced for purposes of erosion control in the sand dunes and have been addressed in Section 4.2.2. A list of invasive species in Inverhuron Provincial Park has been adapted from the "Priority Invasive Plants in Southern Ontario" list developed by the Ontario Invasive Plants Working Group and existing botanical inventories to serve as a guideline for management decisions (Appendix 6) (Havinga *et al.* 2000).

Not all non-native species have shown invasive tendencies in the park and it is not realistic to expect that all invasive species can be removed from the park, as they can be difficult to control. The spread of invasive species should be monitored within the park and priority species for management should be based on ecological threat and ease of control, priority being given to those species that pose the greatest threat and are the easiest to control (OMNR 2001). Actions to prevent further introductions into the park include:

- Using native species in plantings;
- Eradicating invasive species when they first appear (Havinga *et al. 2000*).

Invasive species of concern in the park include the non-native strain of Common Reed (*Phragmites australis*) located on the beach and in the interior wetlands in the natural environment zone, and Mezer's Daphne (*Daphne mezereum*) in the campgrounds. The population of Common Reed within the park is small and control should be strongly considered as it potentially threatens SAR values in the dunes and can easily be controlled at this time. Mezer's Daphne within the campgrounds should be monitored to determine if action is needed, as it has been known to be invasive in parts of southern Ontario (Havinga *et al.* 2000).

Invasive species management prescriptions for selected species can be seen in Appendix 7. Additional prescriptions will be appended to the plan as required.

## 6.0 SPECIES AT RISK

Ontario Parks policy PM 11.03.02 states that the "preservation of species at risk in provincial parks is an inherent part of the Provincial Park system's protection objective." The policy further states that "in certain cases, passive management (i.e., non-intervention) of species at risk and habitat will not guarantee the perpetuation of that species. If this is determined, then active management will be prescribed" (OMNR 2001).

Currently there are two records of Committee on the Status of Endangered Wildlife in Canada (COSEWIC) / OMNR listed plant species at risk in Inverhuron Provincial Park, i.e., Pitcher's Thistle and Dwarf Lake Iris. Aside from the COSEWIC listed species, there are also seven provincially rare to uncommon (S1-S3) plants found at Inverhuron (Johnson and Parker 1975, Johnson 1981). A summary of the communities in the park where each is found and/or any key biological and management issues of each is provided in sections 6.1 to 6.9. A total of 37 plants are also identified as being locally rare or uncommon in Southern Bruce County (Bruce-Grey Plant Committee 1997), which are listed in Table 2 in section 6.10.

There are also a number of rare, sand dune-associated invertebrate species within the park that bear consideration in vegetation management decisions. An outline of these species and management implications are provided in section 6.11. If additional species at risk are discovered in the park, management prescriptions will be developed and appended to the plan in consultation with the zone ecologist.

### *6.1 Pitcher's Thistle (Cirsium pitcheri)*

**(G3, S2 Endangered)**

Pitcher's Thistle is a provincially and federally endangered plant species that is a candidate for regulation under the provincial *Endangered Species Act*. The presence of Pitcher's Thistle is well documented at Inverhuron (Johnson 2000, N. Toth, Personal Communication 2006). It is an Upper Great Lakes endemic and is not found anywhere else in the world (COSEWIC 2000).

Pitcher's Thistle grows on the open sandy habitat found on high beaches, foredunes, blowouts and beach ridges. It is adapted to living in a harsh environment, is somewhat tolerant of burial from sand (2-3 cm annually) and can withstand high soil temperatures. Prior to flowering, the species goes through three life stages as a seedling, rosette and adult, taking 3-11 years to reach maturity before dying.

The *Pitcher's Thistle Lake Huron Dune Grasslands Recovery Strategy* (Jalava 2004) defines the species' survival and recovery habitat as follows:

#### *Pitcher's Thistle Survival Habitat*

"Survival habitat for Pitcher's Thistle must include the area occupied by extant populations as well as a buffer zone for mitigating potential adverse influences of adjacent land uses. Because natural sand dynamics (colonization, stabilization and blowout) are critical functions to the dune system on which Pitcher's Thistle depends, survival habitat must include such processes. Artificial structures that affect deposition of sand must be considered in recovery and management. A population viability assessment may be necessary to define population- and habitat-size thresholds necessary for self-sustaining populations, particularly along southern Lake Huron" (Jalava 2004).

#### *Pitcher's Thistle Recovery Habitat*

"The recovery habitat of Pitcher's Thistle should include sufficient lands to maintain self-sustaining populations and to permit future growth, expansion and migration. It may also include areas where populations formerly existed, if the habitat is still suitable or recoverable. Further research will be necessary to define the attributes of optimum habitats. Pitcher's Thistle recovery habitat should have the characteristics listed above for survival habitat, and include management plans and strategies to prevent threats. Recovery habitat requires the complete range of dune zonation, protection of dune processes, low predator populations, un-fragmented areas of dominant grass species, and lack of threats (or the potential to enact mitigation measures)" (Jalava 2004).

Any revisions to the survival and recovery habitat definitions by the recovery team will be incorporated into the plan.

The population of Pitcher's Thistle at Inverhuron has been well monitored (Toth, unpublished data). In the early 1990s seed was collected from the park and germinated in greenhouses. One hundred or more seedlings were transplanted back into the park in an attempt to augment the population (Johnson 2000).

There is a well established recovery team in place for this species, and park or zone staff should continue to participate on the team. Monitoring of the population should also continue to contribute to recovery efforts and determine if park activities threaten the species. (See Section 7.0)

### *6.2 Dwarf Lake Iris (Iris lacustris)*

**(G3, S3 Threatened)**

Dwarf Lake Iris is provincially rare to uncommon (S3) and designated as threatened on the Species at Risk in Ontario list (SARO[2]). There is an historical observation of the species at Inverhuron from 1979 "among rocks near forest edge near beach." This species has not been relocated since 1979, which may be attributed to poor accuracy associated with the sightings (TSH 2003).

Dwarf Lake Iris is an Upper Great Lakes endemic that grows on sandy gravelly beach ridges or dolostone bedrock in shallow calcareous soils often associated with Eastern White Cedar and Balsam Fir, preferring semi-shaded habitat with the water table close to the surface. It is a small iris (10 cm) that reproduces primarily vegetatively and flowers from May to mid-June (COSEWIC 2004).

### *6.3 Ram's Head Lady's Slipper (Cypripedium arietinum)*

**(G3, S3)**

There is an historical record (1984) of Ram's Head Lady's Slipper that notes the species as being present in the park. The presence of the species has not since been reconfirmed which may be attributed to poor accuracy associated with the original sighting (TSH 2003).

Locally Ram's Head Lady's Slipper is found in semi-open conifer woods in dry places on bedrock, often near alvars, less often on sand. (Bruce-Grey Plant Committee 2001).

### *6.4 American Beachgrass (Ammophila breviligulata)*

**(G5, S3)**

American Beachgrass is common along the shoreline and foredune of the park in the SBOD1-1 *Little Bluestem-Switchgrass-Beachgrass Open Graminoid Sand Dune Type* community.

### *6.5 Great Lakes Wheat Grass (Elymus lanceolatus ssp. psammophilus)*

**(G5,S3)**

Great Lakes Wheat Grass is found on the foredune and blowouts in the park in the SBOD1-1 *Little Bluestem-Switchgrass-Beachgrass Open Graminoid Sand Dune Type* community, and has been transplanted from other areas of the park (N. Toth Personal Communication).

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[2] **SARO:** Species at Risk in Ontario List – The official list of status designations assigned to native Ontario species by the Ontario Ministry of Natural Resources, used in the application of provincial legislation and policy for the protection of species at risk and their habitat.

### 6.6 Sand Reed Grass (Calamovilfa longifolia var. magna)

**(G5,S3)**

Sand Reed Grass is found on the foredune and blowouts in the park in the SBOD1-1 *Little Bluestem-Switchgrass-Beachgrass Open Graminoid Sand Dune Type* community.

### 6.7 Blue-leaf Willow (Salix myricoides var. myricoides)

**(G4T4 S2S3)**

Blue-leaf Willow was reported by Johnson (1981) at Inverhuron Bay in the SBOD1-1 *Little Bluestem – Switchgrass – Beachgrass Open Graminoid Sand Dune Type* and the SBTD1-20 – *White Cedar-Balsam Fir Treed Sand Dune Type* communities.

### 6.8 Low Nutrush (Scleria verticuillata)

**(G5,S3)**

Low Nutrush was reported by Johnson (1981) in the exclusion zone.

### 6.9 Puccoon (Lithospermum carolininense var. croceum)

**(G4G5T4T5 S3)**

This variety of Plains Puccoon was reported by Johnson (1981) in the SBTD1-2 *Balsam Poplar Treed Sand Dune Type* community. It was not noted in 2007, but a search for the plant did not occur until early August.

### 6.10 Locally Rare Plants in Inverhuron Provincial park

Table 2. lists 37 species of plants that are rare or uncommon in Southern Bruce County, as noted in *A Checklist of Vascular Plants for Bruce and Grey Counties* (Bruce-Grey Plant Committee 1997).

*Table 2. Locally rare or uncommon plants in Inverhuron Provincial Park*

| Common Name | Scientific Name |
|---|---|
| Sweet Cicely | *Osmorhiza berterii* DC. (*O. chilensis*) |
| Lindley's Aster | *Aster ciliolatus* Lindley |
| Spurred Stickseed | *Hackelia deflexa* (Wahlenb.) Opiz |
| Tower Mustard | *Arabis glabra* (L.) Bernh. |
| Common Water Starwort | *Callitriche palustris* L. |
| Maple-leaved Viburnum | *Viburnum acerifolium* L. |
| Downy Arrowwood | *Viburnum rafinesquianum* Schultes |
| Sleepy Catchfly | *Silene antirrhina* L. |
| Seaside Spurge | *Chamaesyce polygonifolia* (L.) |
| Showy Tick Trefoil | *Desmodium canadense* (L.) DC. |
| Beach Pea | *Lathyrus japonicus* Willd. |
| Golden Corydalis | *Corydalis aurea* Willd. |
| Germander, Wood Sage | *Teucrium canadense* L. |
| Common Butterwort | *Pinguicula vulgaris* L. |
| Cut-leaved Anemone | *Anemone multifida* Poiret ex Lam. |
| Bristly Buttercup | *Ranunculus pensylvanicus* L.f. |
| Showy Mountain Ash | *Sorbus decora* (Sarg.) Schneider |
| Blunt-leaved Bedstraw | *Galium obtusum* Bigelow |
| American Speedwell | *Veronica americana* (Raf.) Schwein |
| Purslane Speedwell | *Veronica peregrina* L. |

| Common Name | Scientific Name |
|---|---|
| Hoary Vervain | *Verbena stricta* Vent. |
| Brown-headed Fox Sedge | *Carex alopecoidea* Tuckerman |
| Short Beaked Sedge | *Carex brevior* (Dewey) Mackenzie |
| Coniferous Wood Sedge | *Carex concinna* R.Br. |
| False Golden Sedge | *Carex garberi* Fern. |
| Muhlenberg's Sedge | *Carex muhlenbergii* Schk. ex Willd. |
| Prairie Hummock Sedge | *Carex richardsonii* R.Br. |
| Fen Star Sedge | *Carex sterilis* Willd. |
| Brook Nut Sedge | *Cyperus bipartitus* Torrey |
| Tufted Bulrush | *Scirpus cespitosus* L. |
| Alaska Orchid | *Piperia unalascensis* (Sprengel) Rydb. |
| Round Leaved Orchis | *Plantanthera orbiculata* (Pursh) Lind. var. *orbiculata* |
| Shining Ladies' Tresses | *Spiranthes lucida* (Eaton) Ames |
| Big Bluestem | *Andropogon gerardii* Vitman |
| Nodding Fescue | *Festuca subverticillata* (Pers.) Alexeev |
| Tall Manna Grass | *Glyceria grandis* S. Watson |
| Northern Comandra | *Geocaulon lividum* (Richardson) Fern. |

## *6.11 Rare Invertebrates with Dune Association*

A number of rare, sand dune-associated invertebrate species were detected at Inverhuron during an arthropod survey of dune ecosystems, which was conducted throughout Ontario by the University of Guelph Systematics Laboratory for the Pitcher's Thistle Recovery Team (Marshall 2004). Most of these species are either strict dune indicator species or bear strong preference for lakeshore dunes, and are rare in the province of Ontario. S Ranks are still being developed for most (D. Sutherland, Personal Communication 2007). Table 3 provides a list of the dune-associated species detected at Inverhuron during the survey.

Since many of these species are dune obligates, they bear consideration during any dune management activities. Any management activity that would change the normal ecology of the dunes should be reviewed for consideration of these species, and experts in the field consulted prior to initiation.

*Table 3. Rare dune associated arthropods detected in Inverhuron Provincial Park*
From Marshall (2004)

| | Species | Comments |
|---|---|---|
| Hymenoptera-Aculeata | *Ammophila cleopatra* | Very rare at Inverhuron. Only known locality on Lake Huron and is the most northerly site in Ontario. |
| | *Ammophila harti* | Inverhuron supports a thriving population – may be largest population in Ontario |
| | *Mimumesa canadensis* | Threatened by excessive foot traffic on beaches |
| | *Mimesa dawsoni* | Prefers dune areas with shifting sand and scattered dune grasses. |
| | *Crossocerus maculiclypeus* | Found in dunes along Lake Huron and Superior. Especially common at Inverhuron. |
| | *Microbembex monodonta* | Reaches northern limit of its Huron population near Inverhuron. |
| | *Euodynerus auranus* | Restricted to Lake Huron dunes. Prefers pristine dunes, and should be considered endangered. |
| | *Anoplius apiculatus autumnalis* | May be rarest species of the genus. Inverhuron locality at the northern limit of its distribution in Ontario. |
| | *Aporinellus taeniolatus* | Inverhuron at the northern limit of its distribution |
| Diptera | *Phthiria* spp. | Two or three species found at Inverhuron. |
| | *Spirviverpa* sp. | Common at Inverhuron. |
| | *Proctacanthus hinei* | Known from only a few sites in Ontario including Inverhuron. |

| | Species | Comments |
|---|---|---|
| Orthoptera | *Trimerotropis huronia (Lake Huron Locust)* | Common further north, but not found south of Inverhuron. Very abundant in Pitcher's Thistle sites and undoubtedly plays a major ecological role. |
| Coleoptera | *Cicindela hirticollis (Beach Dune Tiger Beetle)* | The only truly shoreline associated tiger beetle. At Inverhuron the species occurs mostly in a small area immediately south of the boat launch where it appears to be in danger of extirpation due to excessive foot traffic. |
| | *Stereopalpus vestitus* | Common at Inverhuron |
| | *Stereopalpus mellyi* | Common at Inverhuron |

## 7.0 REASEARCH AND MONITORING

Research projects within Inverhuron will be encouraged where they improve knowledge, management practices and protection objectives of the park. Research activities must be approved and be consistent with Ontario Parks Policy PM 2.45. Vegetation management prescriptions will be monitored to evaluate goals and objectives and to determine if modifications are necessary. Where possible, park staff will use standardized data forms and inventory and monitoring protocols to ensure information is collected in a consistent manner. Inventories and monitoring that should be implemented and continued in the park include:

- Establishing long-term ecological monitoring sites throughout the park, similar to campground monitoring;
- Evaluating the threat of non-native forest insects and disease as they occur;
- Inventorying and monitoring invasive species with an emphasis on area and extent occupied by Common Reed and Mezer's Daphne;
- Monitoring species at risk found in the park.

### *7.1 Scots Pine Plantations*

Scots Pine thinning within the treed sand dunes will be monitored using belt transects (e.g., Brower *et al.* 1997) to assess native vegetation and Scots Pine's response to management prescriptions and to aid in establishing a time line and the frequency of thinning intervals. Monitoring should be evaluated against vegetation in control transects and include:

- Tree canopy percentage coverage;
- Regeneration of trees, density and species;
- Height class of Scots Pine encountered (seedling < 1 m, sapling 1-3 m, canopy > 3 m);
- Regeneration of shrubs, density and species;
- Regeneration of herbaceous plants density and species;
- Presence of invasive species;
- Photo monitoring to provide a visual record of results.

### *7.2 Pitcher's Thistle Monitoring*

Level 2 Pitcher's Thistle monitoring should continue at Inverhuron, as recommended in *the Monitoring Protocol for Pitcher's Thistle* (*Cirsium pitcheri*) – *Dune Grasslands* (Bickerton 2004), established by the Pitcher's Thistle – Lake Huron Dune Grasslands Recovery Team. This level of monitoring provides a total count of the population at all three life stages and allows for population trends to be examined over time. Monitoring should be conducted in July or early August when adult plants are in flower.

### *7.3 Campground Monitoring*

Post-construction monitoring of campground facilities at six permanent sample plots for forest wildlife habitat will continue (TSH 2003). Collection of data on downed woody debris, forest canopy, tree cavities, understory structure, ground vegetation and ground substrate will follow the protocols outlined by Bellhouse *et al.* (2004). In addition, forest bird monitoring is conducted at these plots following the protocol outlined by Cadman *et al.* (1998).

Other voluntary monitoring programs such as Forest Bird Monitoring and the North American Butterfly Association (NABA) Butterfly Count will continue. Although not directly related to vegetation, they provide valuable information as to the habitat within the park (TSH 2003).

## 8.0 IMPLEMENTATION PRIORITIES

Implementation of the vegetation management plan shall occur in an ecologically sustainable manner. All requirements of the *Environmental Assessment Act*, *Environmental Bill of Rights*, *Endangered Species Act*, *Provincial Parks and Conservation Reserves Act* and other pertinent legislation will be met. Implementation and/or site plans will precede any development or resource stewardship initiatives, with an appropriate level of consultation. Vegetation management projects will be contingent upon the availability of funding and unforeseeable changes in priorities or park policy.

All vegetation management projects will be undertaken in accordance with the requirements of *A Class Environmental Assessment for Provincial Parks and Conservation Reserves*.

The following are implementation priorities of vegetation management prescriptions at Inverhuron Provincial Park and will be subject to funding, staffing and available resources:

- Implement Scots Pine under-planting and thinning program;
- Implement dune education and awareness campaign;
- Continue to monitor species at risk;
- Invasive species monitoring and control (i.e., Common Reed);
- Develop, if needed, additional beach access points and better define existing access;
- Continue with campground monitoring;
- Establish long-term ecological monitoring plots;
- Evaluate forest insects and disease as they occur.

## 9.0 SUMMARY OF CONSULTATION AND ENVIRONMENTAL ASSESSMENT REQUIREMENTS FOR IMPLEMENTATION

Ontario Parks announced its intention to undertake a vegetation management planning project for Inverhuron Provincial Park in early March 2007. The initial notice was mailed to 344 individuals and interest groups inviting public participation.

In late March 2007, a paid advertisement and notice were prepared highlighting the release of the *Draft Inverhuron Vegetation Management Plan*. The notice was mailed to 344 individuals and interest groups. Copies of the draft plan were made available by download from the Ontario Parks' website, http://www.ontarioparks.com/english/invit.html, or by request for printed copies. Ontario Parks' staff considered all comments received during the 45-day consultation period.

The public release of the approved *Inverhuron Vegetation Management Plan* was announced in March, 2008. A paid advertisement was placed in area newspapers and a notice was mailed to 292 individuals and interest groups that participated in the planning process. The approved plan was made available by download from the Ontario Parks' website: http://www.ontarioparks.com/english/invit.html, or by request for printed copies. Implementation of the plan can proceed within 45 days following release of the approved plan.

## 10.0 PLAN AMENDMENT AND REVIEW

The *Inverhuron Vegetation Management Plan* for Inverhuron Provincial Park may be reviewed as required to address changing issues or conditions. Additional species-specific or ecosystem-specific management prescriptions may be added to the document at a later date.

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## APPENDIX 1: Site Conditions Documentation Checklist

Site conditions should be well documented before the implementation of management prescriptions and should include the following as a minimum (Rodger 1998). (N.B. All projects should be screened against the projects in Appendix 2 of the Class EA-PPCR to determine if the project falls within Category A, or if the project requires further screening and EA requirements.)

- Date
- Photographs (before and after)
- GPS Co-ordinates / mapping and site sketch
- Size and location
- Physical features
- Human – made features
- Soils
- Significant cultural features
- Species inventories / composition and density
- Presence of SAR
- Presence of invasive species
- Adjacent land uses
- Current threats
- Official park zoning
- Management constraints and opportunities
- Timing restrictions

Management prescriptions should be monitored and evaluated to determine if management actions are obtaining desired results. Staff carrying out site documentation and monitoring should be given the proper level of training. Because each of the management prescriptions presents its own unique challenges, the zone ecologist should be consulted in the development of monitoring protocols.

## APPENDIX 2: Dead and Hazardous Trees Treatments

The following serve as guidelines for actions to be taken for the removal of dead and hazardous trees (OMNR 2001):

### *1. No Action Required*

No action is required for trees under the following circumstances:

- Dead or living trees which are leaning away from trails and facilities, providing that the turned up root mass will not cause damage to the trails or roads;
- Standing dead trees of species resistant to rot which have a sound trunk and limbs and are not leaning towards trails, roadways or facilities, or located within the campground;
- Trees within naturalized areas which do not pose a risk to facilities, trails or roads outside of the area.

### 2. *Felling*

Felling of a hazardous tree is the recourse to assure safety of the park users and facilities. Complete removal is necessary only when:

- The butt or roots will not provide support to a bare trunk;
- The tree is leaning such that complete failure of the root system is imminent, or such that a hazard is created by the uplifted roots;
- There is substantial cracking in the trunk, indicating that the tree will likely fall with wind or ice accumulation;
- Soil is too thin to support the tree.

Felled trees will be left in place or removed at the superintendents discretion (See Section 4.1.1), provided that they do not impede pedestrian or vehicular traffic, or create a safety hazard. Felling and cutting will be carried out by staff with proper training.

## APPENDIX 3: NHIC Conservation Ranks

Global (G) and Provincial (S) conservation ranks are determined by the number of known and extant sites of a species and the degree to which they are considered to be threatened with destruction. Other criteria include number of known protected populations, population size and the ability of the species to persist at the site (NHIC 2005).

### *Global Ranks*

| *GRank* | *Definition* |
|---|---|
| G1 | **Extremely rare;** usually 5 or fewer occurrences in the overall range or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction. |
| G2 | **Very rare**; usually between 5 and 20 occurrences in the overall range or with many individuals in fewer occurrences; or because of some factor(s) making it vulnerable to extinction. |
| G3 | **Rare to uncommon**; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. |
| G4 | **Common**; usually more than 100 occurrences; usually not susceptible to immediate threats. |
| G5 | **Very common**; demonstrably secure under present conditions. |
| GH | **Historic**; no records in the past 20 years. |
| GU | Status **uncertain**, often because of low search effort or cryptic nature of the species; more data needed. |
| GX | **Globally extinct;** no recent records despite specific searches. |
| ? | Denotes inexact numeric rank (i.e., G4?). |
| G | A "G" (or "T") followed by a blank space means that the NHIC has not yet obtained the Global Rank from The Nature Conservancy. |
| G? | **Unranked**, or, if following a ranking, rank tentatively assigned (e.g., G3?). |
| Q | Denotes that the taxonomic status of the species, subspecies, or variety is **questionable**. |
| T | Denotes that the rank applies to a subspecies or variety. |

### *Provincial Ranks*

| *Pranks* | *Definition* |
|---|---|
| S1 | **Extremely rare** in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation. |
| S2 | **Very rare** in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation. |
| S3 | **Rare to uncommon** in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. Most species with an S3 rank are assigned to the watch list, unless they have a relatively high global rank. |
| S4 | **Common** and apparently secure in Ontario; usually with more than 100 occurrences in the province. |
| S5 | **Very common** and demonstrably secure in Ontario. |
| SH | **Historically** known from Ontario, but not verified recently (typically not recorded in the province in the last 20 years); however, suitable habitat is thought to be still present in the province and there is reasonable expectation that the species may be rediscovered. |
| C | **Captive/Cultivated**; existing in the province only in a cultivated state; introduced population not yet fully established and self-sustaining. |
| S? | **Not ranked yet**; or if following a ranking, rank uncertain (e.g., S3?). S? species have not had a rank assigned. |
| SA | **Accidental**; of accidental or casual occurrence in the province; far outside its normal range; some species may occasionally breed in the province. |
| SAB | Breeding accidental. |
| SAN | Non-breeding accidental. |
| SE | **Exotic**; not believed to be a native component of Ontario's flora. |
| SR | **Reported** for Ontario, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. |

| | |
|---|---|
| SRF | **Reported falsely** from Ontario. |
| SU | **Unrankable**, often because of low search effort or cryptic nature of the species; there is insufficient information available to assign a more accurate rank; more data is needed. |
| SX | Apparently **extirpated** from Ontario, with little likelihood of rediscovery; typically not seen in the province for many decades, despite searches at known historic sites. |
| SZ | Not of practical conservation concern inasmuch as there are no clearly definable occurrences; applies to long-distance migrants, winter vagrants, and eruptive species, which are too transitory and/or dispersed in their occurrence(s) to be reliably mapped; most such species are non-breeders; however, some may occasionally breed. |
| SZB | Breeding migrants/vagrants. |
| SZN | Non-breeding migrants/vagrants. |

The above are not legal status designations and the species at risk in Ontario List (SARO) should be consulted for official status designations used in the application of provincial legislation and policy.

**Status Categories and Definitions for Ontario Species at Risk on SARO List**

| **OMNR Status** | | **Definition** |
|---|---|---|
| **EXT** | **Extinct** | A species that no longer exists anywhere. |
| **EXP** | **Extirpated** | A species that no longer exists in the wild in Ontario but still occurs elsewhere. |
| **END-R** | **Endangered (Regulated)** | A species facing imminent extinction or extirpation in Ontario which has been regulated under Ontario's Endangered Species Act (ESA). |
| **END** | **Endangered (Not Regulated)** | A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's ESA. |
| **THR** | **Threatened** | A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed. |
| **SC** | **Special Concern** [Formerly Vulnerable] | A species with characteristics that make it sensitive to human activities or natural events. |
| **NAR** | **Not at Risk** | A species that has been evaluated and found not to be at risk. |
| **DD** | **Data Deficient** [Formerly Intermediate] | A species for which there is insufficient information for a provincial status recommendation. |

## APPENDIX 4: Use of Sand Fencing

Sand fencing can be used in the beach and foredune to help stop sand from accumulating in undesirable areas. The following guidelines are taken from Peach (2005).

- Fencing requires 40% - 50% porosity for optimum sand accumulation;
- Wood slat snow fencing is preferable; plastic fencing is prone to decay from ultraviolet radiation;
- Fencing is used to slow the onshore wind speeds, allowing sand to accumulate behind the fence;
- The rule of thumb for sand fencing placement is, *"Significant sand deposition will occur in an area behind the fence measuring about eight times the height of the fence."* (i.e., a one-metre-high fence will have significant accumulations eight metres behind it);
- Fencing can be placed during the fall before Thanksgiving weekend and removed in the spring prior to peak tourist season. It can be used all year as well;
- When water levels are low, multiple rows of fencing can be used;
- Note: In areas with Pitcher's Thistle where this management technique is used, sand accumulation should be monitored as Pitcher's Thistle is tolerant of sand accumulations of only *2-3* cm per year;
- It will also be important to monitor sand accumulations and adjust fences accordingly;
- Newly accumulated sand will be loose and susceptible to erosion, and consideration may be given to using this technique in combination with planting to give the accumulated sand stability; (See Appendix 5)
- Sand fencing is generally used for the first 2-3 years of the project until vegetation has been established sufficiently to act as the primary sand-trapping mechanism.

## APPENDIX 5: American Beachgrass Planting

American Beachgrass planting can be used in the beach and foredune to help stabilize the dune and stop sand from accumulating in undesirable areas. The following guidelines are taken from Peach (2005).

- ***Caution*** should be used when using this technique in areas with Pitcher's Thistle as this species may be intolerant of crowding from Beachgrass and it may be more difficult to reverse the effects of this treatment than the use of sand fencing;
- Vegetation provides a longer-term solution to stabilizing beach sand;
- Vegetation provides the same function as sand fencing, by reducing wind speed;
- American Beachgrass, also called Marram Grass, (*Ammophila breviligulata*) is most commonly used;
- "Its applicability is limited to areas where large amounts of sand are expected (e.g., beach and foredune)" (Peach 2005);
- Plant growth is stimulated by burial from sand;
- Planting should take place in the fall, when plants are in a dormant state, increasing chances of survival in the spring;
- Success drops by 25% with spring planting;
- Three to four years are generally required for *Ammophila* to fill in a planted area.

American Beachgrass can be easily transplanted from existing populations at Inverhuron by using the following techniques:

- Plant beach grass parallel to the waterline;
- Keep plant roots moist before planting;
- Plant 18- 24 stems per hole, 17-22 cm deep, 30 cm apart;
- Stagger rows 45 cm apart;
- Compact sand firmly around the plants;
- Protect newly planted area from trampling (New York Sea Grant n.d.)

## APPENDIX 6: Invasive Plants at Inverhuron Provincial Park

Adapted from (Havinga *et al.* 2000) and (Johnson and Parker 1975)

| Scientific Name | Common Name | Effect on Natural Area |
|---|---|---|
| **Category 1** – Species that exclude all other species and dominate sites indefinitely. They may be difficult to control and tend to disperse widely. | | |
| *Alliaria petiolata* | Garlic Mustard | Dominates forest herb layer |
| *Cirsium arvense* | Canada Thistle | Dominates meadows, prairies and forest edges |
| *Phragmites australis* | Common Reed | Dominates wetlands and wet meadows |
| *Rhamnus cathartica* | Common Buckthorn | Dominates forest understory, meadows and prairies |
| **Category 2** – Species that are highly invasive and tend to dominate certain niches. | | |
| *Melilotus alba* | White Sweet Clover | Dominates meadows and prairies |
| *Populus alba* | European White Poplar | Invades meadows |
| *Vinca minor* | Periwinkle | Dominates forest understory |
| *Galium mollugo* | Wild Madder | Invades meadows |
| **Category 3** – Moderately invasive, but can become locally dominant. | | |
| *Dactylis glomerata* | Orchard Grass | Invades meadows and prairies |
| *Salix alba* | White Willow | Invades wetlands, displaces native *Salix spp.* |
| *Salix fragilis* | Crack Willow | Invades wetlands, displaces native *Salix spp.* |
| *Ranunculus repens* | Creeping Buttercup | Invades meadows |
| *Berberis vulgaris* | Common Barberry | Invades forests |
| *Barbarea vulgaris* | Yellow Rocket (Winter Cress) | Invades meadows |
| *Euphorbia cyparissias* | Cypress Spurge | Invades meadows |
| *Pastinaca sativa* | Wild Parsnip | Invades meadows |
| *Convolvulus arvensis* | Field Bindweed | Dominates meadows |
| *Solanum dulcamara* | Bittersweet Nightshade | Invades forests and wetlands |
| *Carduus nutans* | Nodding Thistle | Invades meadows and prairies |
| *Centaurea jacea* | Brown Knapweed | Invades meadows and prairies |
| *Hieracium aurantiacum* | Orange Hawkweed | Invades meadows |
| *Onopordum acanthium* | Scotch Thistle | Invades meadows and disturbed open areas |
| **Category 4** – Can compete with native vegetation and become difficult to eradicate. | | |
| *Bromus inermis* | Smooth Brome Grass | Resists conversion to native meadow and prairie |
| *Lolium perenne* | Perennial Rye Grass | Competes with prairie species |
| *Setaria spp* | Foxtail grasses | Invade prairies |
| *Salix purpurea* | Purple Osier Willow | Invades wetlands, displaces native Salix *spp.* |
| *Rumex acetosella* | Sheep Sorrel | Invades Meadows |
| *Euphorbia esula* | Leafy Spurge | Can dominate prairies |
| *Hypericum perforatum* | Common St. Johns Wort | Can dominate meadows |
| *Nepeta cataria* | Catnip | Invades meadows |
| *Mentha Xpiperita* | Peppermint | Invades meadows |
| *Linaria vulgaris* | Butter and Eggs | Invades meadows |
| *Campanula rapunculoides* | Creeping Bellflower | Invades forest edges and meadows |
| *Tussilago farfara* | Coltsfoot | Invades wet meadows and riverbanks |
| **Potentially Invasive Species to Monitor** | | |
| *Daphne mezereum* | Mezer's Daphne | Has invaded moist forests in S. Ontario |
| *Verbascum thapsus* | Common Mullein | Invades meadows and open forests |

## APPENDIX 7: Invasive Species Control Techniques

| Species | Habitat | Reproduction and Dispersal | Control Methods |
|---|---|---|---|
| **Phragmites** / Common Reed (*Phragmites australis*) | Low-lying wet areas including marshes, drainage ditches, shallow lake edges, sandy banks, roadsides and woodlands (Mal and Narine 2003) | - Primarily vegetative through rhizomes and some seed dispersal (OMNR 2001)<br>- A single plant can spread 1-2 m per year (Wilcox and Petrie 1999) | *Cutting* (OMNR 2001)<br>- Cutting and removal of plants has been effective in some cases. Cutting must be done when maximum nutrient and energy stores are in the above ground shoots.<br>- This treatment may increase the stem density if not conducted properly.<br>- Cutting has resulted in some stands being eradicated and only prevented spread in others.<br><br>*Burning* (Dobbyn 2006)<br>- Burn only in the summer in fire-dependent communities.<br>- Spring and winter burns may increase stem density and below ground biomass.<br><br>*Herbicide Application*<br>- Using backpack sprayer, apply two applications of weathermax 2 weeks apart.<br><br>*Black Plastic* (OMNR 2001)<br>- Place plastic over Phragmites in mid-to late summer for 1-2 months. Ideal for small areas. |
| **Garlic Mustard** (*Alliaria petiolata*) | River floodplains, forests, roadsides, wooded edges and forest openings (Havinga *et al.* 2000). | - Biennial (living two years) rosette and leaves are formed during first half of two-year cycle.<br>- In second spring rosettes develop into mature plants that flower, produce seed and die by late June.<br>- A single plant produces thousands of seeds.<br>- Dispersal of seed can be several metres away from plants.<br>- Spreads rapidly, and can displace native plants within 10 yrs (Havinga *et al.* 2000). | *Cutting* (Havinga *et al.* 2000)<br>- Cut before flowering to prevent seed production.<br>- 2-5 yr treatments required to eliminate seed production.<br>- Cutting can be used on small infestations.<br><br>*Burning*<br>- Stimulates germination of stored seeds and seedling growth.<br>- Must be used annually for 3-5 years to control growth.<br><br>*Herbicide Application*<br>- Glyphosate can be used for large infestations.<br>- Apply glyphosate in mid-spring.<br>- Glyphosate can be applied in mid-spring and fall to rosettes as long as temperature is above 10°C. |
| **Common Buckthorn** (*Rhamnus cathartica*) | Open areas, disturbed forest edges, ravines, forests and wetlands. Shade-tolerant, needs light to be released in the canopy (Havinga *et al.* 2000). | - Will germinate in the shade or sunshine.<br>- Primarily vegetative from roots.<br>-Prolific seed production; seed dispersed by birds.<br>- Produces seed from a young age and is able to form a persistent seed bank.<br>- Root suckers vigorously from cut stumps (Havinga *et al.* 2000). | *Cutting* (Havinga *et al.* 2000)<br>- Cut after peak flowering (May-July).<br>- Follow up with glyphosate application (30%) solution to cut stumps immediately after cutting.<br>- Re-sprouts can be treated 6 weeks after cutting with wick applicator.<br>- Basal bark application with 8% triclopyr.<br><br>*Herbicide*<br>- EZ Ject Lance. |
| **Canada Thistle** (*Cirsium arvense*) | Disturbed areas, cultivated fields, pastures, roadsides, shorelines, forest openings; savannahs and prairies (Havinga *et* | - Primarily vegetative from root system.<br>- Root suckers reproduce vigorously from cut plants.<br>- Reproduces from root stem fragments. | (Havinga *et al.* 2000)<br>- One or more methods of control are often required.<br>- Target killing established clones, targeting seed set is a secondary consideration.<br><br>*Cutting* (Havinga *et al.* 2000)<br>- Mowing plants can be effective but often takes several years. |

| | | | |
|---|---|---|---|
| | *al.* 2000). | - Patches can spread 1-2 m per year.<br>- Vertical roots can grow as deep as 6.8 m.<br>- Horizontal roots can spread as much as 6 m in one season (Havinga *et al.* 2000). | *Burning*<br>- Burn in late spring; often requires several years to control.<br><br>*Herbicide Application*<br>- Deep roots make herbicide control with glyphosate difficult (Havinga *et al.* 2000). |

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